KNOWLEDGE MANAGEMENT, ICT SUPPORT AND REVERSE LOGISTICS PROCESSES: A CASE STUDY

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Abstract

The main purpose of this case study is to identify processes of knowledge management, information and communication technology (ICT) support, and reverse logistics and relations between them in a studied enterprise. Moreover, this study attempts to describe approaches and methods used for performance evaluation of identified processes. Although ICT support of reverse logistics was previously studied to some extent, the relations to knowledge management and performance evaluation in the reverse logistics context have not been investigated. Therefore, this study tries to fill this gap and introduce the possible directions for further research and testing. For an analysis, manufacturing enterprise with approximately 1300 employees located in the Czech Republic was chosen according to results of previous explorative quantitative survey. The reasons of choosing this company were twofold. Firstly, the head of the logistics department (respondent of the survey) was willing to provide initial interview and facilitated the access to company. Secondly, the company (as only one from the few) is supporting reverse logistics processes intensively with ICT, is evaluating ICT support performance and is involved in knowledge management initiatives. Thus, the company serves as a good starting point for in-depth analysis and description of the best practices. Semi-structured interviews with the head of logistics department, human resource department and IT department were conducted. Interviews were analyzed with qualitative data analysis, namely content analysis. The case study reveals potential mechanisms how knowledge management, ICT support and reverse logistics are affecting each other.

Keywords: Knowledge management, performance evaluation, information systems, case study, reverse logistics.

1. INTRODUCTION

Research in Reverse Logistics (RL) has advanced quickly since its emersion in 1990's. However progress in scientific discovery is faster only in certain areas while others are poorly investigated or even left intact. Two areas of RL with minor attention are information support of RL processes and performance measurement. Even lesser attention receives Knowledge Management (KM) in the context of RL. This study, building on previous research in these three areas, tries to explore in detail relationships between KM, RL, IS/ICT and their performance measurement. Also, the study identifies concepts that would be usable in future research.

Therefore, the goal of this study is to describe processes of KM, RL and managing IS/ICT in a company and identify possible relations between attributes and characteristics of these processes. This study will enhance very limited knowledge about managing knowledge and using information support in the context of RL and provide scientists directions for further research and practitioners insights for better management of RL.

2. LITERATURE REVIEW

This study is based on the theory of Closed-loop Supply Chain (CLSC), which encompasses traditional supply-chain (forward flows) and reverse logistics (reverse flows) into one concept (Hosseini, Chileshe, Rameezdeen, Lehmann 2015). In this study, CLSC is understood as: "*the design, control and operation of a system to*

maximize value creation over the entire life-cycle of a product with dynamic recovery of value from different types and volumes of returns over time" (Guide, Van Wassenhove 2006, p. 349).

Literature reviews focused on RL or CLSC do not mention almost any research aimed at KM, IS/ICT or performance management. Except Hosseini et al. (2015) who recommended focusing on product design and management of knowledge and Agrawal et al. (2015) who did not review the area of information technology but are aware of it. The rest of the recent reviews (see Rubio, Chamorro, Miranda 2008; Pokharel, Mutha 2009; Huscroft, Hazen, Hall, Skipper, Hanna 2013; Govindan, Soleimani, Kannan 2015) do not mention or deal with either KM, IS/ICT or performance management.

Although several authors report positive impact of ICT support of RL on performance of RL processes (Daugherty, Myers, Richey 2002; Daugherty, Richey, Genchev, Chen 2005; Huscroft, Hazen, Hall, Hanna 2013; Krčál 2013), the use of ICT support is rather low (at least among Czech and Slovak companies) (Krčál 2013). If the company uses any type of ICT support, it is usually Enterprise Resource Planning (ERP) system (Kokkinaki, Zuidwijk, Nunen, Dekker 2004; Krčál 2013). The performance measurement of ICT support of RL has not been studied yet, as any prior study was not found during the literature search.

The research of KM of RL is limited to few studies focused on creating knowledge framework for product recalls in food industry (Kumar 2014), investigating relationship between knowledge and Green Logistics (Ramírez, Girdauskiene 2013a), investigating impact of KM on RL processes (Ramírez, Girdauskiene 2013b), examining effects of knowledge creation and RL on company performance (Ramírez, García Morales 2011), identifying barriers preventing implementation of KM (Hosseini, Chileshe, Rameezdeen, Lehmann 2015). However, the relationship between information support of RL, KM and RL processes has not been investigated yet.

3. METHODOLOGY

This study extends previous research efforts aimed at IS/ICT support and Knowledge Management (KM) in the field of Reverse Logistics (see Krčál 2012, 2013; Klapalová, Krčál, Škapa 2013) and widens mostly quantitative RL research performed in the Czech Republic (e.g. Klapalová, Škapa, Krčál 2012; Klapalová, Škapa 2013; Škapa 2014; Klapalová, Škapa 2015). The previous studies influenced research design of this study resulting in choosing qualitative exploratory single case study design. The study was conducted in a manufacturing company in the automotive industry with approximately 1700 employees, almost 1 billion Czech crowns (37 mil. €) net worth assets and 1.5 billion Czech crowns (55 mil €) turnover. The company was chosen according to the previous quantitative survey which the company (head of Logistics department) participated in.

Data were gathered from semi-structured interviews. Firstly, head of department of logistics was interviewed by both authors because the interview could not be recorded. Therefore more reliability by comparing the notes from the interview was ensured. After the analysis of data from the first respondent, recorded interviews with the head of human resources and IT department were conducted. The interviews were transcribed and coded by both authors to ensure higher reliability through interceded agreement. Coding was performed without using qualitative data analysis software. For the purpose of interview structuring and data analysis, results from the quantitative questionnaire were used and are presented together with qualitative data analysis in the next section.

4. RESULTS

This section reports results of part of quantitative questionnaire and qualitative data analysis of interviews. The results are divided into specific areas corresponding with the research goal of this study.

4.1. Reverse Logistics

The company deals with all usual reverse flow such as: complaint returns, disposition of unsaleable products, returnable packaging, reuse of materials, waste, and information from customers and suppliers. **Table 1** summarizes data about RL processes collected by the quantitative survey and interviews. According to the data displayed in the table, not a single type of reverse flow differs in the significance. However, unsaleable products were indicated as slightly more important than the rest. The volume of reverse flows was estimated by the head of logistics as 10% of turnover in last 5 years making it 2% of turnover every year on average. However, the precise number is not monitored because not all processes are measured in terms of costs (and revenues). Unsaleable products and materials bind the highest volume of funds followed by reused materials and waste.

According to the head of logistics, the most influencing factors creating the reverse flows are low quality of materials, character of product life-cycle, and insufficient amount of machines and equipment.

Table 1 Types of reverse flows. Source: data analyzed by authors

Process (reverse flow)	Relative significance	Rank of costs volumes	Description of the process	Level of IT support	Impact of IT support	Description of information support
Complaint returns	2 out of 7	N/A	According to the result of the complaint, the product is reworked or either enters into other types of flows. If the complaint is caused by insufficient quality of the product, the complaint goes to quality assurance department, in other cases it goes to sales department.	5 out of 7	5 out of 7	Partially, the process is supported by messaging systems (Lotus Domino) and ERP system (Infor).
Disposition of unsaleable products and material	3 out of 7	1	Priority is reusing (see the appropriate line), and then selling them on secondary markets, when it is not possible they are sold as waste material to recycling.	3 out of 7	5 out of 7	Warehouse module in ERP system is used for automatic monitoring of not used products and materials.
Package returns	2 out of 7	N/A	The company differs internal packaging and external packaging. Internal is not management rigorously, external is usually managed by customers.	5 out of 7	5 out of 7	Except the communication support no coverage in information system.
Reuse (recycling) of materials	2 out of 7	2	Reuse is typical for material not used in customer tailored product that were not	3 out of 7	5 out of 7	Partially is supported by warehouse module in ERP system.
Waste management	2 out of 7	3	Handling regular and manufacturing waste is outsourced.	4 out of 7	3 out of 7	Outsourced
Information flows from customers and suppliers	2 out of 7	N/A	Information from customer are managed by sales department and logistics department in the form of customer's feedback.	5 out of 7	5 out of 7	Messaging system

The distinction between different types of reverse flows is not clear in terms of a physical entity that goes through the processes. Clearly, according to the company's priority, not used products or materials can be used (recycled), or sold on secondary markets. Therefore, the company follows the usual model of CLSC.

Reverse logistics is perceived by C-level management as necessity and it is integrated into the processes from strategic to the operative level. The most important reasons (7 on 7-point Likert scale) for managing reverse flows are customer satisfaction, customer loyalty and better image. Other important (5 on 7-point Likert scale) reasons are cost reduction, productivity increase, value gain, differentiation from the competitors, and legislature.

4.2. Knowledge Management

Knowledge management is regarded as part of the business strategy, and is integrated into business processes. According to heads of logistics and human resources, it is possible to share knowledge and the employees can learn from each other, however according to the head of human resources, this is not visible and intentionally supported by management. Knowledge sharing can be regarded as “forced”, in a way that employees should ensure that they can be substituted by colleagues in case of their absence or leave. Knowledge can be also shared through knowledge base in Lotus Domino system. Employees can open tickets and insert problems description if they are not able to solve and assign the ticket to responsible person or escalate it in the case that the first assigned person is not able to solve it. Solved tickets are stored in the database in order to provide information for future problem solving.

Organizational learning (in this context training) is not, except mandatory legislative training (e.g. workplace security), centralized but managers are responsible for planning the needed training of their employees. Organizational learning can be both external and internal, however external is more frequent. The organizational learning is driven by job description which is divided into three parts: knowledge competences, social competences and language competences.

The training life-cycle of an employee starts with hiring. Then initial internal training (such as legislative training, basic IT knowledge, specific departmental training) is performed. At the end of the first three months period, the employee is interviewed by human resource staff and the decision about future contract is made. After the end of the assessment period, if further training is needed, it is planned in the employee training schedule. Once a year, every employee is interviewed by direct supervisor about his performance and job position. If the supervisor identifies any need for training, job description is updated. If HR department recognizes the need for training the department will add it to the training schedule. The training schedule is being reviewed during the creation of financial plan at the end of the fiscal year. The budget for training is determined by the previous training budgets and by the training demand created by supervisors. If the budget is limited, the priority of training is following: legislatively mandatory training, training focused on audited processes (ISO 9000), training demanded from supervisor, soft and language skills. If the employee is relocated (or the contract is terminated) to the different position he or she has to share the current knowledge with the replacement. At the new position, the cycle begins again with the initial training.

Every training demand has to be justified according to the benefits for the company and for each employee. If any changes in the plan are needed, they are prioritized according to sufficient funds, legislative needs and business strategy. Training evaluation is performed in two ways. First, human resources department qualitatively evaluates participant’s satisfaction with the training by using questionnaires and contractors of the training services are also evaluated. Second, direct supervisor of the participants evaluates impact of the training on participants’ productivity for certain period of time. In most cases, supervisors evaluate the training positively, however employees tend to be more critical. The quantitative (monetary) impact of training is not evaluated in terms of benefits but costs of training are measured.

4.3. Information technology

Information technologies are managed in the company by the demand of users of information systems. This means that if any department needs investment in IS/ICT the reasoning of the investment is in responsibility of the head of the department. Accents on IS/ICT investments are tangible cost savings, time reduction, and productivity increase. The main barrier of investing in IS/ICT (including infrastructure) is low budget. As department of IT cannot influence directly the business strategy but they provide consultancy when needed. Similarly, IT department is not in charge of the implementation projects but is only part of the project team.

Structure of IS corresponds with the production focus of the company. The core of the IS is Enterprise Resource Planning (ERP) system, which is automatically connected to the system used for technological

preparation of production (TPD). TPD is connected with 2D and 3D modeling tools and Product Life-cycle Management systems. Bar code technology connected with ERP is used for monitoring manufacturing. Managing spare parts and tools is supported by autonomous systems. Company uses data warehouse and reporting tools that are used for making automatic reports, OLAP cubes and monitoring KPIs and are based on data in ERP system. Support for RL processes is described in Table 1.

Besides the support for processes directly connected with production, company is using messaging and document management platform (Lotus Domino) and Human Resource (HR) system. Lotus Domino supports not only messaging processes but also knowledge capturing and knowledge sharing processes as it works as knowledge base where employees can store documents, manuals, lessons learned and open tickets for problem solving. HR system supports mainly wages, attendance, and learning.

Evaluation of IT is performed by three approaches: evaluation of costs, benchmarking (only in logistics department), and user satisfaction. Benchmarking is performed by external organization (university) which allows the company to access database with survey results upon completing standardized questionnaire whose data are used for benchmarking. User satisfaction with IT has form of questionnaire which is focused on satisfaction with use of IT technology and services provided by IT department. Information system is not strategically developed as the IT department has not the authority and competence to analyze the system as a whole and to suggest its strategical development.

Investments in information systems are influenced by low budget dedicated for IS/ICT and by “lock-in” in current infrastructure and particular systems. The change would be expensive and the benefits would be mostly intangible. With no proper methods and measures that would appropriately justify the intangible benefits the company does not see the opportunity of better integrated IS worth the costs.

5. CONCLUSION

The goal of this study was to find relationships between RL, IS/ICT and KM. Correspondence between RL processes and IS/ICT is described in **Table 1**. The information support can be regarded as “standard”, however no proper system used for tracking packaging seems not very effective.

Several contradictory findings were identified during the data analysis. The head of IT department considers low budget as main barrier of IS development. Not all RL processes are covered by information systems. However, the head of the logistics department does not perceived any barriers (including money and no potential financial gain) of implementing information support of RL. The company uses no measurements of intangible IT benefits. Knowledge sharing and management is rather decentralized, the same applies for developing IS. The head of the logistics department considers company’s knowledge of RL lower than SCM. Seemingly, this contradiction could have something in common. Firstly, the data do not show that company would align the business strategy IS development. Secondly, intangible benefits are not measurement and decisions seem to omit them. Thirdly, organizational learning and knowledge sharing could be the reason, why the company does not see the opportunity in IS development and do not use (know) about intangible benefits measurement approaches.

This interpretation suggests few directions for further research. Answer for questions: How does the type of business and information strategy affect information support of RL? Is generally lower knowledge of RL processes than SCM processes in companies caused by natural lower volume of reverse flows or by insufficient KM? Does the information support of RL processes differ according to the size of the company and industry the company operates in or general IS for RL can be designed?

These research questions should be of course further developed and possibly redesigned according to more case studies as the qualitative research tends to be in general of lower reliability.

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